IDIOT-PROOFING THE CDE HAM 3 AND HAM 4 ROTATORS

by K M Orchard, TEng, MIElecIE, G3TTC*

After three years as an swl, Keith Orchard became G3TTC in 1964 at the age of 14. He commenced activity on top band with completely home-built gear for home-station, mobile and portable operation. This was followed by operation on 3·5 to 28MHz and 144MHz a.m., and later ssb. From 1971 to 1974 he was on Ascension Island as ZD8KO. He now divides his operation between hf and 144MHz, and he is also interested in construction and rtty.

Professionally he works in hf and mf broadcast engineering, and he is treasurer of his employer's amateur radio club. Other interests include folk dancing, for which there is no known cure.

Introduction

In its basic form, the *Ham* series of rotators has one shortcoming in that if one's finger slips off the BRAKE RELEASE switch while the rotator is turning, mechanical damage to the motor-gearbox assembly is likely to occur. By removing one of three switches fitted to the original control box and adding a relay internally, operation is simplified and the possibility of damage to the motor assembly removed.

The modification requires only a handful of components, a little metalwork and can be done in an evening or two. The brake assembly is operated by a 24V ac solenoid, the armature of which is coupled to a wedge which engages in teeth cast into the lower bell housing. When energized the solenoid withdraws the wedge from the teeth, and the rotator is free to turn.

Original version

Fig 1 shows the circuit of the control box. Bold lines indicate the modifications and should be ignored at this stage. The meter is conventional and displays the beam heading. Rotary switch S1 is in the mains supply, and S2 is a push-switch which forms part of the CALIBRATE potentiometer. S3–5 are three piano-key switches: S3 applies mains to the power transformer, hence energizing the brake release solenoid. When S4 or S5 is operated, power is applied to the motor to give clockwise or counterclockwise rotation repectively. S4 and S5 have no effect until S3 is operated.

To rotate the antenna, operate S3 and S4 (or S5). There is no risk of doing damage to the rotator at this stage because the electrical interlocking between S3 and S4/S5 ensures that the motor cannot be energized in either direction before the brake wedge is retracted.

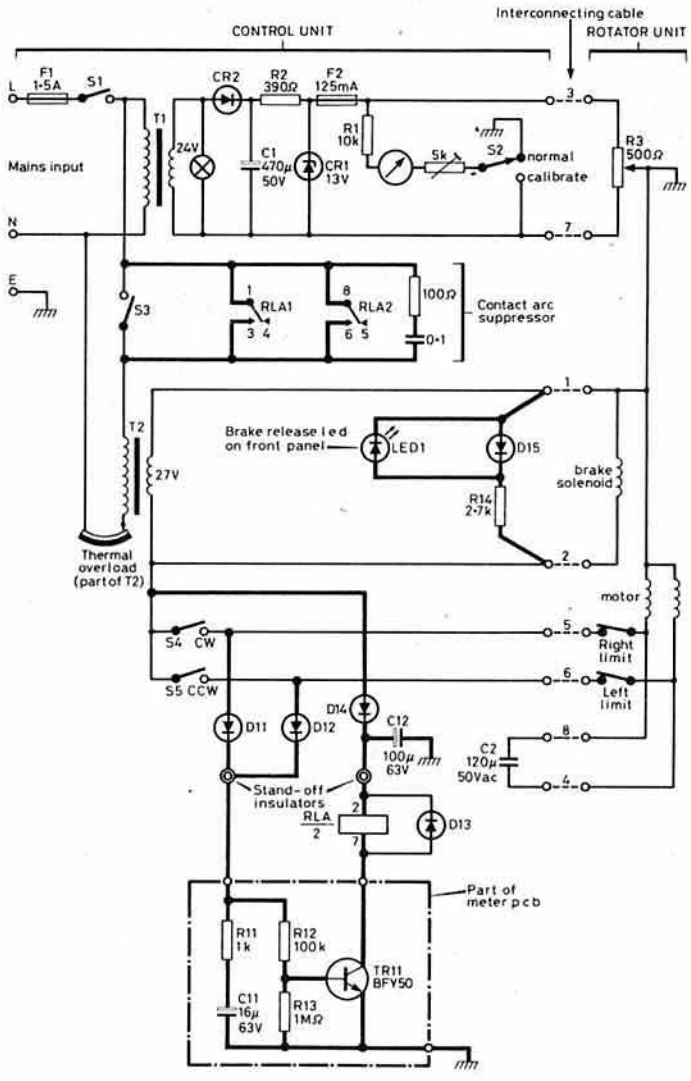
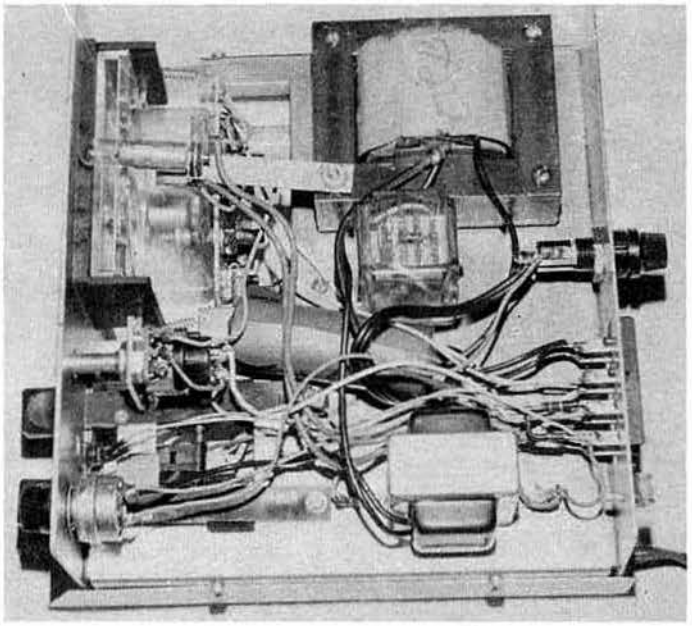


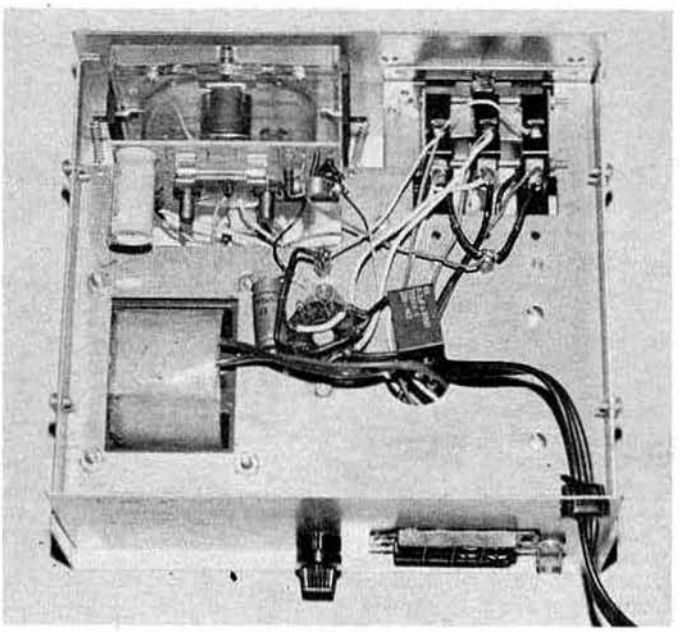
Fig 1. Circuit of control box, additions in heavy line

General view of control box

*5 Hurst Close, Chessington, Surrey KT9 1XE.



Top view of control box chassis



Bottom view of control box chassis

Once the antenna system has reached the desired position S4 (or S5) is released. Due to the momentum of the antenna, particularly a large hf installation, brake switch S3 should be held in the "on" position for several seconds to allow the antenna to come to a complete standstill before the brake wedge is allowed to engage. Later editions of handbooks carry a warning to this effect.

Modified version

The modification entails the removal of the middle switch lever, the fitting of small aluminium extensions to the switch levers of S4 and S5, and the addition of a few components. Bold lines in Fig 1 show additions to the circuit. TR11, RLA and associated components form a time delay circuit which ensures that the rotator brake solenoid remains energized for about 5s after the motor supply has been removed.

S4 and S5 each has a piece of aluminium bolted to its operating lever so that S3 is operated at the same time. When S4 (or S5) is operated, S3's contact closes and mains power is switched to T2, thus energizing the brake release solenoid. C11 charges quickly through R11 and D11 (or D12). TR11 conducts, energizing RLA. D14 and C12 provide a half-wave rectified, smoothed supply for RLA and TR11. Relay contacts RLA1 and RLA2 close in parallel across S3 without effect. LED1 is mounted in the panel space vacated by S3's switch lever, and indicates the presence of the brake release supply.

When the antenna system reaches the desired bearing, S4 (or S5) is released. S3 also opens, but to no effect as RLA1 and 2 are closed. C11 discharges slowly through R11, R12, R13 and TR11, and after about 5s RLA releases. RLA's contacts open to remove the mains supply from T2 and the brake solenoid releases. Five seconds is sufficient for a large antenna system to come to rest, although the delay period can be varied by changing C11. R11, R12, R13, C11 and TR11 can conveniently be mounted on the existing pcb fitted on the rear of the meter.

Components list

R11	1kΩ
R12	100kΩ
R13	1MΩ
R14	2·7kΩ
C11	16μF 63V electrolytic
C12	100μF 63V electrolytic
D11–15	Gen purpose Si power, eg 1N4002
LED1	Rectangular l.e.d. with holder. RS Components 587-103
RLA	Relay, 48V 1·9kΩ, 2p c/o, octal. RS Components 349-535
TR1	BFY50 or similar, Si npn

Miscellaneous:
Contact arc suppressor. RS Components 238-463. Octal base for RLA, two stand-off insulators. Four 8BA by 0·25in screws (or M2 by 6mm), nuts, washers. Four 4BA by 0.25in screws (or M3 by 6mm), nuts, washers. Aluminium sheet 16 and 18swg.

Method

Remove all three levers by undoing their securing screws; one lever can be put aside as it will not need to be refitted. Make up the two aluminium extensions as shown in Fig 2. Using the extensions as templates, drill the two 2·2mm diameter holes in each of the two levers and fix the extensions to the levers using 8BA or M2 screws. Take care when drilling the levers to make one left-hand and one right-hand arrangement. Refit the levers in the chassis and adjust them so that their extensions almost touch. It will be necessary to use a little trial and error to get the angle of each extension so that S3 (the middle microswitch) is operated at about the same time as S4 or S5.

Enlarge an existing 3mm hole in front of the rear panel fuseholder to 28mm (1·125in) to accept an octal holder for RLA. Solder R11, R12, R13, C11 and TR11 to the meter pcb as shown in Fig 3. By using this arrangement, existing pcb track is used; if a fine-tip bit is used it is not even

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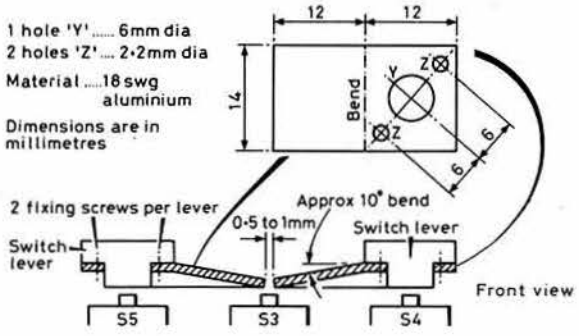

Fig 2. Aluminium extensions—two required

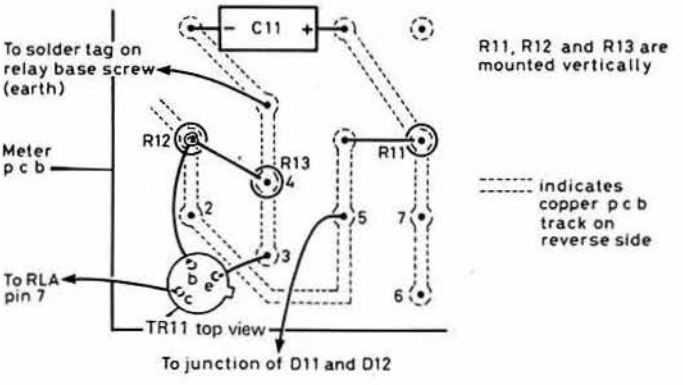

Fig 3. New components mounted on meter pcb

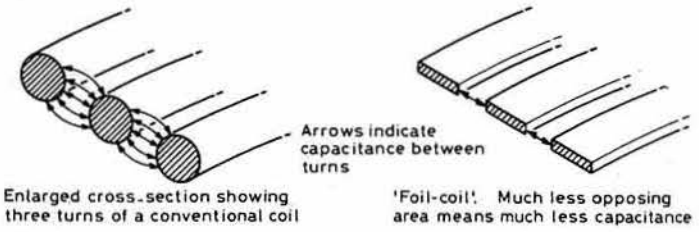
Arrows indicate capacitance between turns
Enlarged cross-section showing three turns of a conventional coil
'Foil-coil'. Much less opposing area means much less capacitance

Fig 8. Cross-sectional areas showing how the distributed capacitance of a coil is reduced by using copper-foil tape

cylindrical formers, adding "Such coils are ideal for a transmatch atu because they exhibit low distributed capacitance" (Fig 8); and for the conversion of a standard reel relay insert into a switchable coaxial connector (an idea he based on an article in *Design News* 28 March, 1983 "Foil tape converts reed switch to switchable coaxial conductor"): see Fig 9. The copper on the hobby tape is 0·0015in thick, so that the current rating for a given thickness of strip may need to be considered. The adhesive provides insulation of an uncertain quality, but this matters little if the base material is suitable for the particular application.

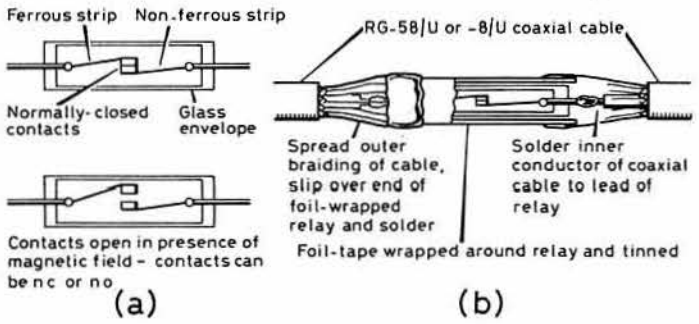
Ferrous strip
Non-ferrous strip
Normally-closed contacts
Glass envelope
Contacts open in presence of magnetic field - contacts can be nc or no
(a)
RG-58/U or -8/U coaxial cable
Spread outer braiding of cable, slip over end of foil-wrapped relay and solder
Solder inner conductor of coaxial cable to lead of relay
Foil-tape wrapped around relay and tinned
(b)

Fig 9. (a) The anatomy of a reed switch; (b) how a coaxial reed relay can be made with the aid of copper-foil tape

70MHz on the cheap

Even if high-quality MoD surplus is in short supply, there are other useful pickings. R. A. Sansoni, G4MWR, points out that many of the "illegal" cordless telephones are now becoming available at give-away prices. Approved frequencies for cordless telephones are now 1·642 to 1·782MHz (base transmit) and 47·456 to 47·543MHz (remote transmit), but there are still in use or in the shops a large number of units with base transmit frequencies about 49MHz and remote transmit 70 to 72MHz. BT have the power to confiscate any unauthorized equipment found connected to their network, and users and dealers are faced with equipment for which there is now virtually no market.

G4MWR finds that the 70MHz base receiver and 70MHz remote transmitter can form the basis of a 70MHz band transceiver of useful performance. He writes: "The sets are crystal-controlled (receiver 59MHz, transmitter 14MHz) with fm deviation of 5 to 7kHz. I have found some models with a receiver sensitivity as good as 0·175μV. Transmitter power can vary from 0·5W to 1·5W on the remote units (authorized models are limited to 0·1W). And there is another bonus; the versions using the 70–72MHz portion for both transmit and receive correspond in channels to the 25kHz spacing and location. The only modification required is to choose the crystals, replace them and disable the logic coding in the receiver or take the af out from the discriminator to a small af amplifier."

Tips and topics

G6ZCY draws attention to a possible source of conductive paint "Chipshield" as demonstrated on "Tomorrow's World" for BBC1, for reducing rf radiation from home computers but which could be applied to any plastics enclosure etc to reduce rfi by providing screening: Bee Chemical Co (UK) Ltd, Kangley Bridge Road, Lower Sydenham, London SE26 5BA. However, at the time of writing he had no details of prices, quantities etc.

G3KXF approves of the publicity given to the recent power-line tragedies, but was surprised to see than nobody referred to the problem of power-line noise radiation which should deter operators from siting antennas anywhere near dangerous power lines. With his motto of "put amateur back into amateur radio" G3KXF fears that "off the shelf" equipment operators may learn little about the does and don'ts of antenna siting and so run into danger. He recalls that one of the first lessons he learned was to avoid "power line QRN".

Dr A.F. Gerrard, G4TFU, was recently caught out by assuming (on the basis of the rather misleading Ambit catalogue details) that the SBL1 double-balanced mixer has the same pin connections as the now less readily available MD108. I recall this point has been made previously in *TT*, but it is worth repeating. You cannot simply substitute an SBL1 for an MD108 without changing the pin connections.

Feedback on the "underground hazards" item in the November *TT*. G3ZPF notes that the mention of manholes should read: "Manholes are usually about 1m deep. Bases should be at least 900mm (*not* 200mm) deep in order to be immune from seasonal movements in the ground." The point he was trying to make was that on large, flat housing developments manholes could be much deeper. Normally the bottom of the base should be about the same depth. □

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necessary to remove the pcb. Two stand-off insulators should be fitted: one just in front of RLA, and the other in the hole vacated by the securing screw of S3's lever. D11, D12, D13, D14 and C12 are fitted below chassis. R14 and D15 are fitted directly onto terminals 1 and 2 of the rear panel terminal board, and two wires brought forward to LED1 which is fitted in the space between the switch levers of S4 and S5 and secured with a dab of glue. The L.E.D. lead-out wires are bent up to clear the lever extensions. The point-to-point wiring should be self-explanatory from a study of the circuit diagram.

Other modifications

Another worthwhile modification is to make the CALIBRATE potentiometer less susceptible to erroneous adjustments. Before modification it was panel-mounted with a knob identical to the adjacent on-off rotary switch, hence the possibility of moving the calibrate setting instead of operating the on-off switch. The modification involves making a bracket on which to mount the potentiometer so that the end of its shaft is level with the front panel. By cutting a slot in the end of the shaft it can be adjusted with a screwdriver.

Fig 4 shows the L-shaped bracket required. It is secured to the chassis by two screws to the left of S5.

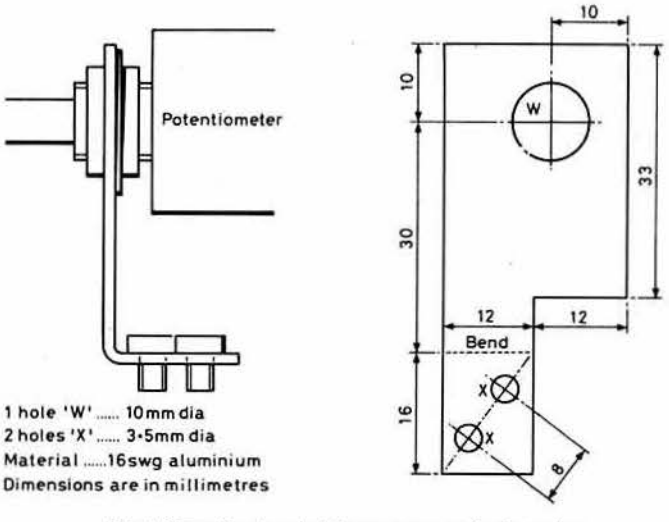

Fig 4. Mounting bracket for CALIBRATE potentiometer

If you have a rotator of American origin, check that the mains input fuse is wired in the *line* feed. In four units which I checked it was found that if the three-pin American plug supplied was used with a British socket, the fuse was found to be in the *neutral*. This is a dangerous situation, since a transformer insulation failure would cause an excessive current to flow in the mains input wiring and possibly make the chassis live. □